General

Guideline Title

ACR Appropriateness Criteria® urinary tract infection — child.

Bibliographic Source(s)

Karmazyn B, Coley BD, Binkovitz LA, Dempsey-Robertson ME, Dillman JR, Dory CE, Garber M, Hayes LL, Keller MS, Meyer JS, Milla SS, Paidas C, Raske ME, Rigsby CK, Strouse PJ, Wootton-Gorges SL, Expert Panel on Pediatric Imaging. ACR Appropriateness CriteriaÂ® urinary tract infection - child. [online publication]. Reston (VA): American College of Radiology (ACR); 2012. 8 p. [91 references]

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Podberesky DJ, Gunderman R, Coley BD, Bulas D, Fordham L, Karmazyn BK, Meyer JS, Paidas C, Prince JS, Rodriguez W, Expert Panel on Pediatric Imaging. ACR Appropriateness Criteria® urinary tract infection - child. [online publication]. Reston (VA): American College of Radiology (ACR); 2008. 9 p.

Recommendations

Major Recommendations

ACR Appropriateness Criteria®

Clinical Condition: Urinary Tract Infection – Child

Variant 1: Age <2 months, febrile urinary tract infection.

Radiologic Procedure	Rating	Comments	RRL*
US kidneys and bladder	9		O
X-ray voiding cystourethrography	6	Consider in boys and in presence of sonographic abnormality.	
Radionuclide cystography	5	Consider in girls.	
Renal cortical scintigraphy	3	Not a first-line test. Could be used 4-6 months after UTI to detect scarring.	

Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate

*Relative Radiation Level

Radiologic Procedure	Rating	Comments	RRL*
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 2: Age >2 months and ≤3 years, febrile urinary tract infection with good response to treatment.

Radiologic Procedure	Rating	Comments	RRL*
US kidneys and bladder	9	May be unnecessary if US in third trimester is normal.	O
Renal cortical scintigraphy	5	Not a first line test. Could be used 4-6 months after UTI to detect scarring.	
X-ray voiding cystourethrography	5	Consider if US or renal cortical scintigraphy is abnormal.	
Radionuclide cystography	4	Consider in girls.	
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 3: Age >3 years, febrile urinary tract infection with good response to treatment.

Radiologic Procedure	Rating	Comments	RRL*
US kidneys and bladder	6	Yield decreases with age.	O
Renal cortical scintigraphy	3	Not a first-line test. Could be used 4-6 months after UTI to detect scarring.	
X-ray voiding cystourethrography	3	Consider if abnormal US.	
Radionuclide cystography	3	Consider in girls.	
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 4: Atypical (poor response to antibiotics within 48 hours, sepsis, urinary retention, poor urine stream, raised creatinine, or non-*E. coli* UTI) or recurrent febrile urinary tract infection.

Radiologic Procedure	Rating	Comments	RRL*
US kidneys and bladder	9		O
X-ray voiding cystourethrography	7		
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation

Radiologic Procedure	Rating	Comments	RRL*
Radionuclide cystography	7	Consider in girls.	
Renal cortical scintigraphy	6	Could be used 4-6 months after UTI to detect scarring.	
CT abdomen and pelvis with contrast	3	Not a first-line test. If abscess is suspected based on US imaging.	
CT abdomen and pelvis without contrast	2	May be useful in rare cases when stone disease suspected.	
CT abdomen and pelvis without and with contrast	1		
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Summary of Literature Review

Introduction/Background

Urinary tract infection (UTI) is the most frequent serious bacterial infection during childhood, affecting approximately 2% of boys and 8% of girls by the age of 7 years. UTI is defined by the presence of bacteria within the urine and is confirmed by a urine culture of at least 5 x 10^4 colony-forming units (cfu)/mL of the same bacterial species on a catheterized specimen or 10^5 cfu/mL on a voided specimen. Approximately 75% of UTIs occur in the first 2 years of life. The first peak of UTI is in the first year of life, and the second peak of UTI occurs between the ages of 2 to 4 years during toilet training. After the age of 6 years, UTIs are infrequent and often associated with dysfunctional elimination.

Cystitis is a UTI limited to the bladder. Cystitis typically presents with localizing symptoms of frequency, urgency, and dysuria. Acute pyelonephritis is infection of the kidneys. Pyelonephritis typically presents with systemic symptoms such as high fever, malaise, vomiting, abdominal or flank pain, and tenderness. Pyelonephritis can cause renal scarring, which is the most severe long-term sequela of UTI that can lead to hypertension and chronic renal failure. With the increased use of antenatal ultrasound (US), it was realized that many of the scars that were attributed to pyelonephritis actually occur in utero and represent renal dysplasia. Contrary to earlier studies suggesting that renal scarring secondary to pyelonephritis is the most common cause of chronic renal disease in children; it is now evident that the long-term risk is low. The role of imaging is to guide treatment by identifying patients who are at high risk to develop recurrent UTIs or renal scarring. However, identification of children at risk is valuable only if there is effective treatment. Current management strategy to prevent recurrent UTIs and renal scarring is based on prophylactic antibiotics and selective surgical correction of vesicoureteral reflux (VUR). Prospective studies failed to demonstrate significant decrease in renal scarring in patients with febrile UTI who were treated with prophylactic antibiotics, and surgical correction of VUR was not found to improve outcome. Thus the effectiveness of current management of UTIs is put into question.

UTI in a neonate requires special consideration. The prevalence of UTI in term neonates varies from 0.1% to 1%, with a male predominance. Neonates with UTI have a high incidence of structural renal anomalies. Concomitant sepsis with UTI is common and was observed in the range of 6% to 36.4%. Therefore routine imaging is recommended for evaluating renal anomalies and VUR in newborns with UTI. As most prospective clinical studies do not include children younger than 2 months we advocate extending this conservative approach to children younger than 2 months.

Most prospective studies on UTIs are done between the age of 2 months to 2 to 3 years, as most UTIs occur in that age group and the incidence of VUR is higher. There is limited medical-based evidence to support routine imaging of uncomplicated UTIs, and optimal imaging is controversial. Currently there are two main methods for evaluating children with UTIs: the bottom-up approach, which focuses on detection of VUR, and the top-down approach, which focuses on the diagnosis of acute pyelonephritis.

Identification of VUR is associated with increased risk of renal scarring. However, not all children with renal scarring have VUR. On the other hand, the majority of children with febrile UTIs will have evidence of pyelonephritis, most of which will resolve regardless of treatment. Prospective randomized studies are needed to determine optimal management and imaging of UTIs.

Pyelonephritis

Pyelonephritis is diagnosed in children based on the presence of pyuria and/or bacteriuria, fever, flank pain, or tenderness. Between 50% and 64% of children who have a febrile UTI are found to have defects on renal cortical scintigraphy (RCS) indicating acute pyelonephritis. The relationship between childhood UTIs, VUR, and renal scarring is complex and not completely understood. Children with VUR are at an increased risk for pyelonephritis and parenchymal scarring, but pyelonephritis or renal scarring commonly occurs without VUR. The incidence of acute pyelonephritis in the absence of documented VUR is much too high to be explained by intermittent VUR. Previous episodes of pyelonephritis or VUR increase the risk for recurrent pyelonephritis. Absence of fever does not exclude development of pyelonephritis.

Long-term Complications

Cystitis in the absence of pyelonephritis is usually not associated with long-term sequelae. The incidence of scarring in children following pyelonephritis varies widely in the literature. A systemic review of the literature showed that 15% (95% confidence interval, 11% to 18%) of the children had evidence of renal scarring after the first episode of UTI. Contrary to common belief, renal scarring after pyelonephritis does not decrease in older children.

Reports from the 1960s and 1970s showed that scarring, secondary to pyelonephritis, is the etiology for 50% of hypertension and 30% of end-stage renal disease (ESRD) in children. Many of the cases that were attributed to scarring from pyelonephritis actually represent congenital hypoplastic or dysplastic kidneys. Scarring accounts for 5% of children with hypertension. Retrospective studies demonstrated that mainly children with bilateral renal scarring are at risk for renal insufficiency. According to the North American Pediatric Renal Trials and Collaborative Studies 2011 report, reflux nephropathy accounted for 3.5% of ESRD. Worldwide, reflux nephropathy accounted for 7% to 17% of ESRD.

Treatment

The main purpose of treating UTIs is to cure pyelonephritis or acute cystitis and to prevent recurrent UTIs and renal scarring. Acute UTIs are typically treated with oral antibiotics. About 13% of the children with febrile UTI who are treated with prophylactic antibiotics will have recurrence of UTI compared to 19% children who do not receive prophylactic treatment. Prophylactic long-term oral antibiotics may decrease the incidence of recurrent UTIs and, therefore, renal scarring. However, the benefit is small and should be weighed against the risk of microbial resistance.

It is not clear if children with dilated reflux benefit significantly from treatment. A recent prospective Swedish reflux trial, randomized treatment (antibiotic prophylaxis, endoscopic correction of reflux, or surveillance) on 203 children with grade III or IV reflux. There was a significantly lower rate of recurrent febrile UTIs in those receiving antibiotics and endoscopic treatment. No scar developed in children treated with antibiotics. However, the number of patients in this study was small. A multicenter prospective randomized trial on the benefit of intervention in children with reflux may provide an answer to this question.

Studies comparing combined antibiotic prophylactic and surgical correction of reflux to antibiotic prophylaxis alone did not find any significant change in the rate of renal scarring. Surgery (open or endoscopic) is usually reserved for high-grade VUR, recurrent UTI despite antibiotic prophylaxis, and noncompliance with prophylactic antibiotics.

Other nonsurgical treatment options are targeted to children with a variety of bladder functional abnormalities, including behavioral modification, biofeedback relaxation of the pelvic floor, and treatment of constipation.

Ultrasonography

Renal ultrasound (US) is a noninvasive imaging method that avoids the risk of ionizing radiation and is readily available. It can detect urinary tract anomalies such as hydronephrosis, duplex renal system, hydroureter, and ureterocele. In older children, postvoid evaluation of bladder volume could be useful to assess for functional bladder abnormalities and retention syndrome. Abnormal renal growth on follow-up US studies may indicate development of parenchymal scarring. Due to interobserver and intraobserver variability, assessment of renal growth is reliable only after a follow-up of at least 2 years.

The sensitivity for detecting VUR and renal scarring is low. There are limited data showing inconsistent results on sensitivity of ultrasound in detection of dilated VUR. Gray-scale US identifies about 25% of acute pyelonephritis and about 40% of chronic parenchymal scarring.

Few studies with small series of children suggested good correlation between power Doppler and technetium-99m (Tc-99m) dimercaptosuccinic acid (DMSA) finding of pyelonephritis. Other studies, however, demonstrated low sensitivity for pyelonephritis and low prediction for development of renal scarring. At this point, therefore, use of power Doppler as a replacement for RCS cannot be recommended. With the increased use of prenatal US screening, the yield of detection of unknown renal abnormalities in children with UTIs is low.

Renal Cortical Scintigraphy

RCS, Tc-99m DMSA, and Tc-99m glucoheptonate are sensitive (90%) and specific (95%) tests for detecting pyelonephritis. However, short-term studies have demonstrated that many of these abnormalities resolve over time, irrespective of whether prophylactic antibiotic was used. This suggests little benefit in using RCS after the first episode of UTI. Persistent parenchymal abnormality in RCS or decreased uptake of tracer associated with loss of contour or cortical thinning are indications of renal scarring. Most recurrent UTIs occur within 3 to 6 months after the first episode of UTI. The UK's National Institute for Health and Clinical Excellence guideline suggests 4 to 6 months of delayed RCS to evaluate for renal scarring in high-risk patients.

RCS, followed by cystourethrography if the RCS suggests pyelonephritis, is the "top down" approach. This approach may decrease the number of cystourethrography studies. Some studies showed high correlation between dilated VUR and positive RCS. However, not all studies demonstrated high correlation between positive RCS and high-grade VUR.

Evidence of acute pyelonephritis is detected by RCS in children with UTIs in about 50% to 80% of cases. RCS may also be helpful in predicting the risk of breakthrough infection and renal damage in children with VUR.

Tc-99m DMSA has higher image quality than Tc-99m glucoheptonate, which makes DMSA a more desirable agent for renal cortical imaging, especially in small infants, in those with poorly functioning kidneys, and when other studies have identified dilated uropathy or high-grade VUR cases. Pinhole imaging or single photon-emission computed tomography (SPECT) should be considered to maximize the sensitivity of RCS without loss of specificity.

RCS is not readily available as compared to X-ray voiding cystourethrography (VCUG). Studies are performed 3 to 4 hours after intravenous injection and may require sedation in young children. The estimated effective dose of DMSA is approximately 1 mSv, which is about 100 times more compared to nuclear cystography and about 10 times more compared to current low-dose VCUG technique.

X-Ray Voiding Cystourethrography and Nuclear Cystography

The main role of VCUG is to detect VUR. Patients with high-grade VUR (grades 3-5) are more likely to have recurrent UTIs and scarring.

The prevalence of VUR in children with UTIs is 30% to 40% and decreases with age. The prevalence of VUR increases in children with recurrent UTIs. VUR is detected with equal sensitivity by fluoroscopic contrast VCUG and direct radionuclide cystography (RNC). A second filling of the bladder (cyclic cystography) increases overall detection of VUR and dilated VUR. Cyclic VUR may be appropriate in children older than 2 years who cannot control voiding and when there is a high suspicion of VUR.

RNC has a lower absorbed radiation dose than VCUG, but it does not have the spatial resolution needed to identify anatomic abnormalities of the urethra, bladder, and ureters. Initial evaluation of VUR in girls and follow-up studies may be done by RNC.

Echo-enhanced cystography is a nonionizing, safe, and reliable method to evaluate for VUR. The bladder is filled with a solution containing microbubbles that appear echogenic in US. However, this procedure is not yet approved for use in United States.

Computed Tomography

Postcontrast CT scan is sensitive in diagnosing pyelonephritis. However, due to its radiation, it should be performed selectively in rare cases when there is suspicion for complications such as renal abscess or xanthogranulomatous pyelonephritis.

Magnetic Resonance Imaging

A small series demonstrated that magnetic resonance imaging (MRI) has high sensitivity for detecting pyelonephritis, comparable to DMSA scintigraphy. The role of MRI in predicting the presence of high-grade VUR or risk of development of renal scarring is unknown. MRI has an advantage over US and DMSA in demonstrating congenital malformations and renal dysplasia. However, MRI is not routinely used in the evaluation of children with UTI due to its high cost, low availability, and need for sedation in younger patients.

Summary

- The long-term risk from febrile UTI is low, and the benefit of treatment, including prophylactic antibiotics and surgery for reflux in children with UTIs, is uncertain in children older than 2 months. Therefore, there is no clear benefit for imaging children with the first episode of UTI who respond well to treatment. The incidence of VUR decreases with age, and therefore imaging may have an even lower yield in guiding treatment in older children. Imaging of UTI in children younger than 2 months may need to be more conservative, as there is limited research on this age group and neonates with UTI have a high incidence of renal anomalies and are more likely to be complicated with sepsis.
- In children with UTI, US can be used to screen for underlying congenital renal anomalies (not including VUR). US may not be necessary if the prenatal US in the third trimester was normal. RCS is the imaging modality of choice to evaluate for acute pyelonephritis and renal scarring. VCUG and nuclear cystography are the imaging modality of choice in evaluation of VUR. Nuclear cystography has significantly lower radiation that VCUG and comparable sensitivity and specificity. Therefore, it is the preferred study to evaluate VUR in girls and for follow-up of VUR.
- VCUG is the preferred study to evaluate for reflux in boys with UTI, as it can demonstrate urethral pathologies. There is not sufficient evidence to support the use of power Doppler US for diagnosing acute pyelonephritis and predicting the risk of renal scarring.
- In complicated UTIs (not responding well to antibiotics within 48 hours, sepsis, urinary retention, raised creatinine, non- E. coli UTI) or recurrent UTIs, the child should be imaged with US. The use of either cystography or DMSA should be considered. If a DMSA study is performed first and is positive, a cystography study should follow.

Anticipated Exceptions

Nephrogenic systemic fibrosis (NSF) is a disorder with a scleroderma-like presentation and a spectrum of manifestations that can range from limited clinical sequelae to fatality. It appears to be related to both underlying severe renal dysfunction and the administration of gadolinium-based contrast agents. It has occurred primarily in patients on dialysis, rarely in patients with very limited glomerular filtration rate (GFR) (i.e., <30 mL/min/1.73 m^2), and almost never in other patients. There is growing literature regarding NSF. Although some controversy and lack of clarity remain, there is a consensus that it is advisable to avoid all gadolinium-based contrast agents in dialysis-dependent patients unless the possible benefits clearly outweigh the risk, and to limit the type and amount in patients with estimated GFR rates <30 mL/min/1.73 m^2. For more information, please see the American College of Radiology (ACR) Manual on Contrast Media (see the "Availability of Companion Documents" field).

Abbreviations

- CT, computed tomography
- E. coli, *Escherichia coli*
- US, ultrasound
- UTI, urinary tract infection

Relative Radiation Level Designations

Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
O	0 mSv	0 mSv
	<0.1 mSv	<0.03 mSv
	0.1-1 mSv	0.03-0.3 mSv
	1-10 mSv	0.3-3 mSv
	10-30 mSv	3-10 mSv
	30-100 mSv	10-30 mSv

*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (e.g., region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as "Varies."

Clinical Algorithm(s)

Algorithms were not developed from criteria guidelines.

Scope

Disease/Condition(s)

Urinary tract infection (UTI)

Guideline Category

Diagnosis

Evaluation

Prevention

Clinical Specialty

Emergency Medicine

Family Practice

Infectious Diseases

Nephrology

Nuclear Medicine

Pediatrics

Radiology

Urology

Intended Users

Health Plans

Hospitals

Managed Care Organizations

Physicians

Utilization Management

Guideline Objective(s)

To evaluate the appropriateness of initial radiologic examinations in pediatric patients with urinary tract infection

Target Population

Children with urinary tract infection

Interventions and Practices Considered

1. Ultrasound (US) kidneys and bladder
2. X-ray voiding cystourethrography
3. Radionuclide cystography
4. Renal cortical scintigraphy
5. Computed tomography (CT) abdomen and pelvis
    - With contrast
    - Without contrast
    - Without and with contrast

Major Outcomes Considered

- Utility of radiologic examinations in differential diagnosis
- Recurrent urinary tract infections (UTIs)
- Renal scarring
- Long-term sequelae

Methodology

Methods Used to Collect/Select the Evidence

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Literature Search Procedure

The Medline literature search is based on keywords provided by the topic author. The two general classes of keywords are those related to the condition (e.g., ankle pain, fever) and those that describe the diagnostic or therapeutic intervention of interest (e.g., mammography, MRI).

The search terms and parameters are manipulated to produce the most relevant, current evidence to address the American College of Radiology Appropriateness Criteria (ACR AC) topic being reviewed or developed. Combining the clinical conditions and diagnostic modalities or therapeutic procedures narrows the search to be relevant to the topic. Exploding the term "diagnostic imaging" captures relevant results for diagnostic topics.

The following criteria/limits are used in the searches.

1. Articles that have abstracts available and are concerned with humans.
2. Restrict the search to the year prior to the last topic update or in some cases the author of the topic may specify which year range to use in the search. For new topics, the year range is restricted to the last 5 years unless the topic author provides other instructions.
3. May restrict the search to Adults only or Pediatrics only.
4. Articles consisting of only summaries or case reports are often excluded from final results.

The search strategy may be revised to improve the output as needed.

Number of Source Documents

The total number of source documents identified as the result of the literature search is not known.

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Strength of Evidence Key

Category 1 - The conclusions of the study are valid and strongly supported by study design, analysis, and results.

Category 2 - The conclusions of the study are likely valid, but study design does not permit certainty.

Category 3 - The conclusions of the study may be valid but the evidence supporting the conclusions is inconclusive or equivocal.

Category 4 - The conclusions of the study may not be valid because the evidence may not be reliable given the study design or analysis.

Methods Used to Analyze the Evidence

Review of Published Meta-Analyses

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

The topic author drafts or revises the narrative text summarizing the evidence found in the literature. American College of Radiology (ACR) staff draft an evidence table based on the analysis of the selected literature. These tables rate the strength of the evidence for all articles included in the narrative text.

The expert panel reviews the narrative text, evidence table, and the supporting literature for each of the topic-variant combinations and assigns an appropriateness rating for each procedure listed in the table. Each individual panel member forms his/her own opinion based on his/her interpretation of the available evidence.

More information about the evidence table development process can be found in the ACR Appropriateness Criteria® Evidence Table Development document (see the "Availability of Companion Documents" field).

Methods Used to Formulate the Recommendations

Expert Consensus (Delphi)

Description of Methods Used to Formulate the Recommendations

Modified Delphi Technique

The appropriateness ratings for each of the procedures included in the Appropriateness Criteria topics are determined using a modified Delphi methodology. A series of surveys are conducted to elicit each panelist's expert interpretation of the evidence, based on the available data, regarding the appropriateness of an imaging or therapeutic procedure for a specific clinical scenario. American College of Radiology (ACR) staff distributes surveys to the panelists along with the evidence table and narrative. Each panelist interprets the available evidence and rates each procedure. The surveys are completed by panelists without consulting other panelists. The ratings are a scale between 1 and 9, which is further divided into three categories: 1, 2, or 3 is defined as "usually not appropriate"; 4, 5, or 6 is defined as "may be appropriate"; and 7, 8, or 9 is defined as "usually appropriate." Each panel member assigns one rating for each procedure per survey round. The surveys are collected and the results are tabulated, de-identified and redistributed after each round. A maximum of three rounds are conducted. The modified Delphi technique enables each panelist to express individual interpretations of the evidence and his or her expert opinion without excessive bias from fellow panelists in a simple, standardized and economical process.

Consensus among the panel members must be achieved to determine the final rating for each procedure. Consensus is defined as eighty percent (80%) agreement within a rating category. The final rating is determined by the median of all the ratings once consensus has been reached. Up to three rating rounds are conducted to achieve consensus.

If consensus is not reached, the panel is convened by conference call. The strengths and weaknesses of each imaging procedure that has not reached consensus are discussed and a final rating is proposed. If the panelists on the call agree, the rating is accepted as the panel's consensus.

The document is circulated to all the panelists to make the final determination. If consensus cannot be reached on the call or when the document is circulated, "No consensus" appears in the rating column and the reasons for this decision are added to the comment sections.

Rating Scheme for the Strength of the Recommendations

Not applicable

Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

Internal Peer Review

Description of Method of Guideline Validation

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria.

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The recommendations are based on analysis of the current literature and expert panel consensus.

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Selection of appropriate radiologic imaging procedures for evaluation of pediatric patients with urinary tract infection

Potential Harms

- Renal cortical scintigraphy (RCS) may require sedation in young children. The estimated effective dose of dimercaptosuccinic acid (DMSA) is approximately 1 mSV, which is about 100 times more compared to nuclear cystography and about 10 times more compared to current low-dose X-ray voiding cystourethrography (VCUG) technique.
- Due to its radiation, computed tomography (CT) should be performed selectively in rare cases when there is suspicion for complications such as renal abscess or xanthogranulomatous pyelonephritis.

Gadolinium-based Contrast Agents

Nephrogenic systemic fibrosis (NSF) is a disorder with a scleroderma-like presentation and a spectrum of manifestations that can range from limited clinical sequelae to fatality. It appears to be related to both underlying severe renal dysfunction and the administration of gadolinium-based contrast agents. It has occurred primarily in patients on dialysis, rarely in patients with very limited glomerular filtration rate (GFR) (i.e., <30 mL/min/1.73 m^2), and almost never in other patients. Although some controversy and lack of clarity remain, there is a consensus that it is advisable to avoid all gadolinium-based contrast agents in dialysis-dependent patients unless the possible benefits clearly outweigh the risk, and to limit the type and amount in patients with estimated GFR rates <30 mL/min/1.73 m^2. For more information, please see the American College of Radiology (ACR) Manual on Contrast Media (see the "Availability of Companion Documents" field).

Relative Radiation Level (RRL)

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Patients in the pediatric age group are at inherently higher risk from exposure, both because of organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared to those specified for adults. Additional information regarding radiation dose assessment for imaging examinations can be found in the ACR Appropriateness Criteria® Radiation Dose Assessment Introduction document (see the "Availability of Companion Documents" field).

Qualifying Statements

Qualifying Statements

The American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

Staying Healthy

IOM Domain

Effectiveness

Identifying Information and Availability

Bibliographic Source(s)

Karmazyn B, Coley BD, Binkovitz LA, Dempsey-Robertson ME, Dillman JR, Dory CE, Garber M, Hayes LL, Keller MS, Meyer JS, Milla SS, Paidas C, Raske ME, Rigsby CK, Strouse PJ, Wootton-Gorges SL, Expert Panel on Pediatric Imaging. ACR Appropriateness CriteriaÂ® urinary tract infection - child. [online publication]. Reston (VA): American College of Radiology (ACR); 2012. 8 p. [91 references]

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

1999 (revised 2012)

Guideline Developer(s)

American College of Radiology - Medical Specialty Society

Source(s) of Funding

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria®.

Guideline Committee

Committee on Appropriateness Criteria, Expert Panel on Pediatric Imaging

Composition of Group That Authored the Guideline

Panel Members: Boaz Karmazyn, MD (*Principal Author and Panel Vice-chair*); Brian D. Coley, MD (*Panel Chair*); Larry A. Binkovitz, MD; Molly E. Dempsey-Robertson, MD; Jonathan R. Dillman, MD; Christopher E. Dory, MD; Matthew Garber, MD; Laura L. Hayes, MD; Marc S. Keller, MD; James S. Meyer, MD; Sarah S. Milla, MD; Charles Paidas, MD; Molly E. Raske, MD; Cynthia K. Rigsby, MD; Peter J. Strouse, MD; Sandra L. Wootton-Gorges, MD

Financial Disclosures/Conflicts of Interest

Not stated

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Podberesky DJ, Gunderman R, Coley BD, Bulas D, Fordham L, Karmazyn BK, Meyer JS, Paidas C, Prince JS, Rodriguez W, Expert Panel on Pediatric Imaging. ACR Appropriateness Criteria® urinary tract infection - child. [online publication]. Reston (VA): American College of Radiology (ACR); 2008. 9 p.

Guideline Availability

Electronic copies: Available from the American College of Radiology (ACR) Web site .

Print copies: Available from the American College of Radiology, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

Availability of Companion Documents

The following are available:

- ACR Appropriateness Criteria®. Overview. Reston (VA): American College of Radiology; 2 p. Electronic copies: Available in Portable Document Format (PDF) from the American College of Radiology (ACR) Web site.
- ACR Appropriateness Criteria®. Literature search process. Reston (VA): American College of Radiology; 1 p. Electronic copies: Available in PDF from the ACR Web site.
- ACR Appropriateness Criteria®. Evidence table development – diagnostic studies. Reston (VA): American College of Radiology; 2013 Nov. 3 p. Electronic copies: Available in PDF from the ACR Web site.
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Patient Resources

None available

NGC Status

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